Taxi Cab Syndrome: A Review of the Extensive Genitourinary Pathology Experienced by Taxi Cab Drivers and What We Can Do to Help

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This review consolidates knowledge regarding the extensive genitourinary pathology experienced by taxi cab drivers. Taxi cab, livery, truck, and other drivers all objectively and subjectively may have more voiding dysfunction, infertility, urolithiasis, bladder cancer, and urinary infections as compared with nonprofessional drivers; this is called *taxi cab syndrome*. Together with governmental and medical assistance, simple interventions—such as education, the addition of taxi relief stations, and possibly the use of sanitary urinary collection devices—to curb the progression of genitourinary disease in taxi drivers should be prospectively studied. It is postulated that many of these interventions may also benefit other groups of occupationally related infrequent voiders.

[Rev Urol. *2014;16(3):99-104 doi: 10.3909/riu0627]*

KEY WORDS

Taxi cab syndrome • Infrequent voiders syndrome • Occupational hazard • Voiding dysfunction • Prostodynia • Infertility • Urolithiasis

In New York City, where taxi cabs flow like erythrocytes in a vast net of arteries, the drivers, New York's backbone, often do not have sufficient flow themselves. This article demonstrates how the lack of adequate and accessible bathroom facilities in New York likely accounts for most of the genitourinary pathology that taxi drivers have. In fact, drivers represent only one of many occupations that contribute to voiding dysfunction as a result of inadequate bathroom access or other factors that lead to the inability to void regularly throughout the workday. These drivers represent the ultimate case study on how, using simple interventions, those who move us through New York City at an often bewildering speed may be helped.

In the aptly worded article by Gany and colleagues,[1] "Every disease…man can get can start in this cab," the cardiovascular risk factors of New York City taxi cabs are described in great detail. Gany and colleagues followed a cohort of South Asian immigrant taxi drivers, holding focus groups and administering surveys about the drivers' perceptions of their own cardiovascular health. Musculoskeletal pain, diabetes, hypertension, vision problems, stress, obesity, and constipation were pervasive throughout the group. Additionally, urinary tract issues such as kidney problems, bladder dysfunction, and prostatism were noted. One of the participants attributed his onset of kidney problems to intentional infrequent urination, and said this was mostly "because you don't have facilities at most places where you can stand and urinate." Two other drivers with diabetes-induced polyuria also attributed their severe problem with this issue.[1]

Infrequent Voiders Syndrome

The entity being described by these drivers has been documented sparingly in the past, and was first dubbed as "the infrequent voider" by Lalli and Lapides in 1969. Specifically, they noted that "voiding with less than usual frequency can result in the development of urinary tract infections, renal failure, and the attendant difficulties."[2]

In 1985, Kinn studied 10 patients who were known to chronically suppress their impulses to void, leading to high capacity bladders (greater than 1000 mL for the study subjects). Using data from previous literature, she theorized that the "neurologic lazy detrusor is due to deterioration of neuromuscular transmission after mechanical overdistension... [and] as the muscle fibers become progressively overstretched, they gradually sustain permanent loss of contractility, [where after] fibrosis later develops in the muscular tissue and the end result is a decompensated bladder with failure to initiate and sustain a micturition contraction."[3] This can be similar in concept to non-neurogenic neurogenic bladder described by Hinman.[4]

Bendtsen and colleagues,[5] who termed this *infrequent voiders syndrome*, studied nurses who were known to exhibit an "habitual suppression of the desire to void over a [long] period of time... resulting [in the] overdistension of the bladder muscle [which] damages bladder sensation and increases the bladder capacity." They theorized that a hectic work schedule, coupled with poor access to adequate toilet facilities, was the root cause of infrequent voiding. Interestingly, the nurses in this study had a 16% prevalence of self-reported cystitis (no documented urine studies confirmed this), as compared with a 6% prevalence for average childbearing women.[5]

Bellina and associates[6] studied 10 women who had demanding occupational work environments and who all had self-reported chronic voluntary infrequent voiding patterns. Using urodynamics and cystoscopy, they diagnosed all of these women with either mild or moderate reduction in urinary flow rate, 90% with moderate to severe trigonitis, and 80% with bladder trabeculations. All of these women also had between 1 and 4 episodes of nocturia nightly. The authors proposed a simple solution that consisted of education and a computer alert system that would send automated messages every 3 hours suggesting a bathroom break.[6]

A 1975 study that used the distended bladders of rabbits as a model postulated that chronic bladder distension with bladder pressures consistently greater than the mean arterial blood pressure leads to a decrease in blood flow and eventually to bladder hypoxia.[7] Bladder hypoxia, consequently, has been associated with urinary infections. A Danish study from 1994 analyzed 1613 women, 7.7% of whom noted that they voided 3 or fewer times per day. These women were found to have statistically more urinary infections as compared with women with 4 or more voids per day.[8]

A significant characteristic of the infrequent voiders syndrome is the intentional restriction of fluid intake in order to reduce need to urinate throughout the day.

A significant characteristic of the infrequent voiders syndrome is the intentional restriction of fluid intake in order to reduce need to urinate throughout the day. This pattern has been linked to urinary stone formation. Embon and colleagues[9] studied 708 patients with diagnosed urolithiasis through the use of questionnaires and 24-hour urine collections. Low urine volume, described in the paper as chronic dehydration (19%), was the second most prevalent finding after idiopathic hypercalciuria. Interestingly, 40 of the 98 patients who were classified as chronically dehydrated noted poor water intake as at least one of the reasons for this.[9]

In a prospective study of over 45,000 men with no history of kidney stones, Curhan and colleagues[10] found that those who had greater than 2500 mL of fluid intake per day had a statistically reduced risk

of developing urolithiasis over 4 years of follow-up, as compared with control subjects who had less than 1275 mL of fluid intake per day (multivariate adjusted relative risk [RR] = 0.71; 95% CI, 0.52-0.97; adjustment factored in age, profession, thiazide use, alcohol intake, and dietary intake of calcium, animal protein, and potassium).[10] The sequelae of those with infrequent voiders syndrome appears to consist of development of urinary tract infections, renal failure, urolithiasis, and bladder dysfunction caused by detrusor weakness.

Prostate Issues

One of the first studies to investigate the relationship between occupational groups and prostatic disease was conducted by Kim and colleagues in 1998.[11] The study used International Prostate Symptom Score (IPSS), urinary flow rates and patterns, transrectal ultrasounds, and prostate-specific antigen (PSA) levels to compare 405 taxi drivers and 110 barbers to 93 patients with known prostate symptoms. They found taxi drivers to have similarly elevated IPSS scores as compared with the patient reference group, and significantly elevated values compared with barbers (17.5, 17.53, and 13.22, respectively; $P < .05$). Taxi drivers, when compared with barbers and the patient reference group, had an increased incidence of abnormal voiding patterns (51.6%, 28.2%, and 39.78%, respectively), ejaculatory duct abnormalities (36.29%, 20.0%, and 20.43%, respectively), and prostatodynia (28.9%, 22.7%, and 39.78%, respectively). Taxi drivers also had an increased incidence of prostatitis as compared with barbers (29.5% vs 20.9%). The authors attributed prolonged sitting, pelvic floor tension, and infrequent urination to be the cause of these problems in the taxi driver group.[11]

Another study from South Korea compared 192 taxi drivers to 120 sedentary desk workers with regard to lower urinary tract symptoms (LUTS) and prostate-associated symptoms. They used the IPSS scoring system as well as the National Institute of Health-Chronic Prostate Symptom Index (NIH-CPSI) to test their hypothesis. Results showed that taxi drivers worked considerably longer shifts (12.96 h vs 9.32 h, respectively; $P < .001$), but were of similar age to the control group. They found taxi drivers to have significantly elevated IPSS scores as compared with the control group (8.06 vs 5.3; $P < .001$); this significance persisted after stratification based on irritative, obstructive, and quality-of-life scores. Similarly, taxi drivers were found to have significantly elevated NIH-CPSI scores as compared with the control group (9.45 vs 5.18; $P < .001$); this significance also persisted after stratification for pain, urinary symptoms, and quality-of-life impact scores. They also concluded that the habitual absence of voiding and prolonged sedentary work environments of taxi drivers led to these findings.[12]

An additional report from South Korea also compared taxi drivers with office workers using IPSS scores, but expanded their study with uroflowmetry levels (UF), transrectal ultrasound (TRUS), and PSA levels. The two groups were statistically similar in age and body mass index (BMI). Again, taxi drivers were found to have significantly elevated IPSS scores as compared with the office workers (13.53 vs 9.71, respectively). PSA level, prostate volume based on TRUS, and maximal flow rate (Q_{max}) on UF were statistically similar between the two groups.[13]

Infertility

A study conducted by the China Family Planning Association in concert with the International Planned Parenthood Federation surveyed 350 male taxi drivers in Beijing, China. Through history and physical examination, they found that the rate of prostatitis was 10% higher in taxi drivers than in the general population. The same study, interestingly, found that the rate of erectile dysfunction in this cohort was 56.7%, well above China's national prevalence of 20%, although this was not adjusted for any demographic factors such as age.[14] (Unfortunately, the primary source of this report was not found despite extensive research on both English and translated Chinese Web sites. Numerous lay sources, however, confirmed the statistics of this report.) Another group from China performed a cross-sectional analysis of 2500 men aged 18 to 30 years, assessing them for prostatitis through a questionnaire. They found 128 subjects (6.02%) who met criteria for chronic prostatitis, and found prolonged sitting, as well as long-time urine holding, to be significant risk factors.[15]

Chronic prostatitis and impaired fertility have both been explained by a common risk factor: prolonged sitting while driving.

Chronic prostatitis and impaired fertility have both been explained by a common risk factor: prolonged sitting while driving. In 1979, Sas and Szöllösi[16] studied a group of 2984 patients, of whom 281 were professional drivers. They found that the drivers had a significantly increased incidence of pathospermia (defined as any deviation from the normal spermiogram) as compared with the other patients (64% vs 55%), and that prevalence increased in proportion to the number of years driving.[16] Figà-Talamanca and colleagues[17] studied

a group of 72 male taxi drivers from Rome, comparing them with 50 matched control subjects (similar age and smoking habits) through the collection of salivary testosterone levels, semen analysis, and surveys that assessed fertility experience. They found that taxi drivers had significantly lower prevalence of normal sperm forms (45.8% vs 64.0%), and that this association was enhanced for those who had been driving for a longer duration of time.[17]

The above studies theorized that impaired spermatic features and longer time to fertility are due to prolonged sitting and the sequelae of this passive activity. A study from Italy that describes the link between chronic prostatitis and infertility in certain occupations that predispose men to chronic sitting, such as driving vehicles, attributed this link to chronic intrapelvic venous congestion.[18] A retrospective study of 402 couples by Thonneau and colleagues[19] studied the effects of occupational heat exposure on fertility. They found that professional drivers who were seated in a vehicle for more than 3 hours per day had a statistically longer time required to achieve fertility as compared with control subjects (median, 4.5 mo; mean, 14.4 vs median, 2.8; mean, 7.8, respectively).[19] This group later studied nine volunteer men who were asked to walk for 40 minutes and then drive a car for close to 3 hours while having their scrotal temperatures recorded. They demonstrated that driving is associated with a 1.7°C to 2.2°C increase in scrotal temperature, and that this increase can further elevate with increased time driving—they concluded that testicular heat exposure was likely the most significant risk factor for reduced male factor fertility in drivers.[20]

Finally, a review paper from 2009 extensively studied the possibility that whole body vibration may be the reason for reduced fertility in drivers. They concluded that there is weak evidence to support this theory, and that confounding factors such as pelvic heat exposure and venous congestion, as well as comorbidities such as hypertension, heart disease, and diabetes, likely lead to impaired spermatogenesis as well as reduced erectile capacity, and that these factors together can help explain the adverse reproductive outcomes found in drivers.[21]

Bladder Cancer

Professional driving has also been noted to be a risk factor for the development of bladder cancer. One of the first studies to find this relationship was conducted in Copenhagen from 1979 to 1981. After obtaining occupational histories and excluding persons with missing information, the researchers analyzed 371 cases and compared them with 771 referents. After controlling for age, tobacco smoking history, and sex, they found that occupation as a bus, taxi, or truck driver led to a significantly increased risk for developing bladder cancer (RR = 1.29; 95% confidence interval [CI], 1.05-1.59). This risk further statistically increased with longer duration of employment as a driver, which may be due to increasing exposure to compounds associated with diesel fuels, traffic fume exposure in general, and gasoline or grease exposure.[22] A recent meta-analysis that searched the MEDLINE and Embase databases sought to combine data on all known occupational studies that calculated risk of bladder cancer. They extracted nine studies regarding bladder cancer risk for car, taxi, and van drivers and found the risk ratio to be 1.20 (95% CI, 1.03-1.39). However, after controlling for cigarette smoking, the association was no longer statistically significant (RR = 1.20; 95% CI, 0.99-1.46).[23]

We propose a formal definition for what we call *taxi cab syndrome*: the increased incidence of LUTS, urolithiasis, bladder and voiding dysfunction, prostatitis, bladder cancer, reduced fertility, and urinary tract infections found in taxi cab drivers due to a multifactorial array of abuses directed at their genitourinary tracts.

The Perfect Example

A case study by Chang and Goldfarb[24] in 2003 describes a longtime chauffeur who presented initially with nocturia and frequency of urination. Interestingly, they describe a urodynamic finding of a "hyposensate, hypocontractile dilated bladder without evidence of a mechanical obstruction." Further radiologic work-up also revealed numerous and bilateral kidney stones in this patient. The patient had only one risk factor, which was that he was often forced by his employer to drive continuously for 6 to 7 hours at a time, and as a result limited his fluid intake as to avoid the need to urinate.[24]

Review of Lay Literature

The array of urologic disease found in taxi cab drivers is indeed quite staggering. A thorough review of the lay literature, however, will help to demonstrate that this problem is indeed especially grave in New York City, and will serve to show why a study aimed at finding simple interventions to address these issues is so desperately needed.

As of 2012, the New York City Taxi & Limousine Commission (TLC) reported that 110,572 drivers worked in 13,237 taxi cabs and 41,062 other for-hire vehicles, with 98.9% of these drivers being men.[25]

In a 1995 *New York Times* article, a fleet owner discussed that "many of his drivers were making successful worker's compensation claims for bladder, kidney, and prostate problems." The article goes on to describe a reform by the TLC that at the time agreed to increase the number of taxi relief stands from 13 to 28.[26]

In theory, these stands are intended to give cabbies a legal area to stop their car and seek relief by eating, resting, and using the bathroom. Since 1995, the number of stands has not significantly grown. A recent review of the New York City Department of Transportation's Web page entitled "Taxi and For-Hire Vehicle Relief Stands" revealed that there are currently no relief stands in Staten Island, and only two each in the Bronx and Brooklyn. Manhattan, where most of the taxis operate, has 32 relief stands, and Queens, where many of the taxi fleet parking lots are located, has 15 relief stands.[27]

That being said, the term *relief stand* appears to be somewhat of a misnomer and should not be considered synonymous with the ability to use a toilet. In a wNYC.org article from 2010, it was noted, "only one [relief stand] that recently opened in lower Manhattan has onsite bathrooms drivers can use." The article goes on to quote a disgruntled taxi driver, who said, "Relief taxi stand. This means relief only for the car, not for the person."[28]

The logical next step is a review of the laws pertaining to the health standard requirement of workplaces. In fact, these laws appear to be quite simple—the more people you employ, the more toilets you need to provide. Specifically, according to the Occupational Safety and Health Administration, a division of the United States Department of Labor, "toilet facilities…shall be provided in all places of employment…[and] the number of facilities…shall be based on the number of employees…for whom the facilities are furnished." Numerically speaking, the law requires an "additional fixture for each additional 40 employees" over 150.[29] Based on our calculations (110,572 total drivers in 54,299 vehicles, using the rough estimation that at any given time approximately half of these cars will be in service), New York City should provide at least 675 taxi relief stands with associated designated toilets for taxi and other drivers.

So why then, in a city with almost 14,000 taxi cab drivers and numerous other livery vehicles, do we only currently provide only 51 designated relief stands for our taxi drivers, most of which are not near accessible toilet facilities? The law provides leeway that allows the city to look past the needs of mobile workers because it states "the requirements of this paragraph… do not apply to mobile crews…"

The term relief stand *appears to be somewhat of a misnomer and should not be considered synonymous with the ability to use a toilet.*

It should be clear that even a slight change of our attitudes and the work environment might help prevent our taxi cab drivers from developing taxi cab syndrome.

Conclusions

A multitude of occupational hazards in New York City preclude many taxi drivers from living a healthy life, and from a urologic perspective, this often results in the development of what we term taxi cab syndrome. Unfortunately, drivers are only one of many types of workers who, due to environmental work restraints, seem to be prone to become infrequent voiders. We suggest that prospective studies should focus on the implementation of a few simple interventions that could help prevent taxi cab syndrome from further manifesting in New York City taxi drivers and which can likely also be extrapolated to other groups of infrequent voiders. These interventions should include education (eg, the importance of diet, fluid intake, adequate bladder emptying, and techniques to limit heat exposure to the genital region), a more extensive network of taxi relief stands with nearby accessible toilet facilities, and possibly providing drivers with urinary collection devices that may encourage the drivers to urinate in a sanitary, controlled setting within the private confines of their vehicle. We envision that, with the aid of the city government, taxi fleet owners, consulting urologists, and independent well-wishers, much can be done to combat this problem—one that affects not only the taxi cab population of New York City, but all types of drivers and other infrequent voiders. ■

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MAIN POINTS

- A multitude of occupational hazards in New York City, and throughout the world, preclude many taxi drivers from living a healthy life, and from a urologic perspective, this often results in the development of *taxi cab syndrome*.
- Cab drivers, and other professionals who are often constantly at the service of others and have environmental work constraints, such as nurses, often become infrequent voiders. In general, these infrequent voiders are more likely to have voiding dysfunction, urolithiasis, and urinary infections. Drivers may also develop higher rates of infertility and bladder cancer as compared with nonprofessional drivers.
- To help reduce the prevalence of this situation, the authors suggest civic and medical interventions such as education (eg, the importance of proper diet, fluid intake, adequate bladder emptying, and techniques to limit heat exposure to the genital region), and a more extensive network of taxi relief stands with nearby accessible toilet facilities.